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FIFTH BIMONTHLY PROGRESS REPORT

UNIVERSITY OF ALASKA

ERTS PROJECT 110-8

May 30, 1973

- A. TITLE OF INVESTIGATION: Sea Ice and Surface Water Circulation,
Alaskan Continental Shelf.
- B. PRINCIPAL INVESTIGATOR/GSFD ID: G. D. Sharma, F. F. Wright
and J. J. Burn/UN683
- C. PROBLEMS IMPEDING INVESTIGATION: Imagery received during the reporting
period consisted of only negative and positive films and prints are
anticipated on a routine basis. Mr. Belon, Coordinator of University
of Alaska ERTS Project 110-1 provided some useable imagery (photographs)
including those discussed in this report.
- D. PROGRESS REPORT:

1) Accomplishments during reporting period:

Negative and positive images (no prints) have been received for 23 March,
1, 2, 3, 4, 6 and 11 April 73. Routine viewing of these images
indicated that the sea ice is very distinctly displayed in the imagery
and would have a significant application for this study.

Analyses of the imagery provided by Mr. Belon covered regions
of eastern Chukchi and Bering Seas during 6, 7 and 8 March 1973. The
individual ice masses on these prints can be easily delineated and
thus their movement can be traced during subsequent imagery. Sequence

(E73-10620) SEA ICE AND SURFACE WATER
CIRCULATION, ALASKAN CONTINENTAL SHELF
Bimonthly Progress Report (Alaska Univ.,
Fairbanks.) 8 p HC \$3.00 CSCL 08C

N73-24381

Unclas

G3/13 00620

of three images provide the distribution of various ice types and their movements in the Bering Strait during this period (Fig. 1).

The most noteworthy accomplishment during this report period was the use of ERTS-1 imagery to locate and trace the movements of various sea ice mass and polynya as demonstrated by March 73 imagery. Mapping of these ice features can be significant navigational aid in Bering and Chukchi Seas, sea mammal migration in northern seas and sea ice circulation. Sea ice studies were conducted at no cost to the project.

Suspended sediment sampling in Cook Inlet was attempted during the satellite passes of 26-27 March, 14-15 April and May 20-21, 1973. Clear weather was slightly promising in the early morning and cruises were conducted on 27 March and 14 April, however, skies were too overcast at the time of satellite pass for the satellite to obtain any imagery. The weather was such that cruises were not even attempted on the other days of satellite passes.

The sampling data obtained on 27 March and 14 April 1973 does indicate that the same general suspended sediment distribution as observed in the November 3 and 4, 1972, satellite imagery still exists in the lower Cook Inlet. The general suspended sediment distribution differs only in absolute concentration. Even with the large concentrations of ice in the lower Cook Inlet during the 27 March cruise, the concentration of suspended sediment within the water was fairly uniform but decreased slightly with depth below the surface. Melting ice was observed to be

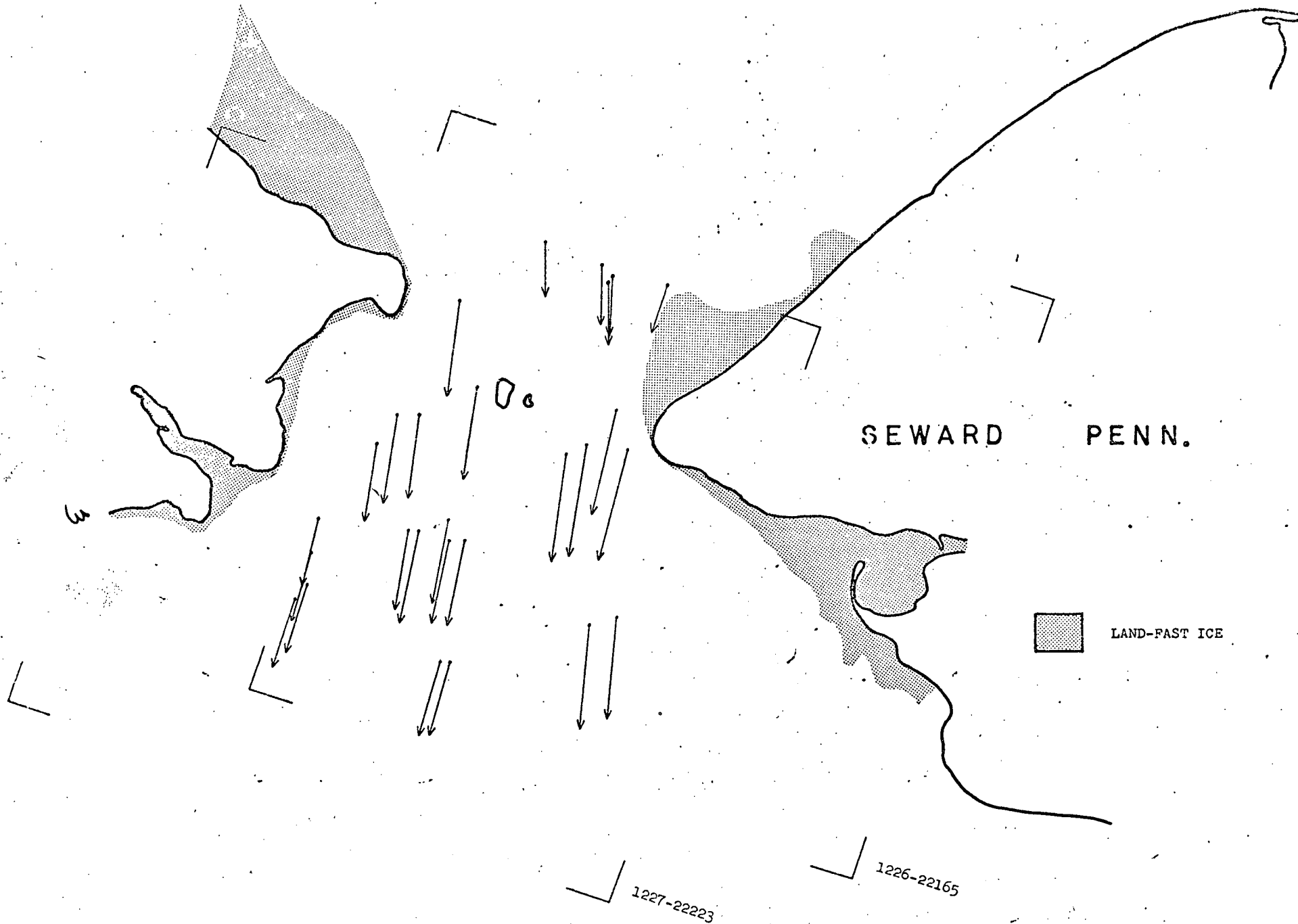


Figure 1. Movements and directions of ice floes in Bering Strait and Bering Sea during 6 and 7 March 1973.

a major source of the near surface suspended sediment and would account for the higher near-surface suspended sediment concentrations which were measured.

The general homogeneity of the suspended sediment load throughout the water column measured during the 27 March cruise lends further evidence to the supposition that in estuaries such as Cook Inlet determination of the surface suspended sediment load can provide an accurate estimation of the total suspended sediment load varied throughout the water column.

2. Plans for the next reporting period: ERTS-1 imagery obtained during late winter and spring of 1973 from Bering Sea is anticipated in the near future and the analysis of all available imagery will be attempted. Cruises in Cook Inlet are planned for obtaining ground truth data during the overhead ERTS-satellite pass during June and July 1973. Surface water samples will also be collected during June, July and August in the Bering Sea.

E. SIGNIFICANT RESULTS: See separate page.

F. PUBLICATIONS: (1) F. F. Wright and G. D. Sharma, Satellite Observations of High Latitude Estuarine Circulation, Port and Ocean Engineering Under Arctic Conditions. (Submitted)

(2) F. F. Wright and G. D. Sharma, ERTS Studies of Alaskan Coastal Circulation, American Society of Photogrammetry Convention, Orlando, Florida. (Submitted).

G. RECOMMENDATIONS: None

H. CHANGES IN STANDING ORDER FORMS:

Submitted March 19, 1973

Approved?

I. ERTS IMAGE DESCRIPTOR FORMS: None

J. DATA REQUEST FORMS:

Submitted April 4, 1973

Submitted April 9, 1973

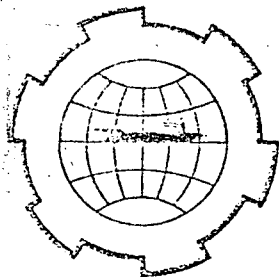
Data Query May 18, 1973

Not received

Not received

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SATELLITE OBSERVATIONS OF HIGH LATITUDE
ESTUARINE CIRCULATION

Name and position

F. F. Wright, Asst. Prof.

Unit or Institution

Institute of Marine Science
University of Alaska

Place and country

Fairbanks,
Alaska, USA

G. D. Sharma, Assoc. Prof.

Abstract here

ABSTRACT

Sea surface circulation in Alaskan coastal waters can be monitored effectively using Earth Resources Technology Satellite imagery. Turbid river waters and ice have proven to be excellent tracers for such studies. In the summer, runoff from a recently deglaciated hinterland will carry large quantities of fine sediment which may remain in suspension at the surface throughout the estuarine zone and often beyond the shelf. When runoff is restricted during the winter, ice preferentially forms from the fresher waters at the heads of estuaries and it, too, follows the trajectory of the outflowing waters. ERTS imagery in the MSS 4 or 5 Bands ($0.5-0.6$ or $0.6-0.7\mu$) clearly shows the turbid waters; the MSS 7 Band ($0.8-1.1\mu$) readily distinguishes floating ice.

ERTS studies of Cook Inlet, a large estuary in southern Alaska, have clarified the complex local circulation regime. Cook Inlet is a long, shallow estuary with high amplitude mixed tides. Currents, tidal bores, shoaling, and weather make Cook Inlet an extremely difficult area to study. Conventional oceanographic techniques cannot remotely provide synoptic coverage of the inlet. The circulation pattern becomes intelligible, however, when standard techniques are combined with satellite observations. The circulation is tide-forced with considerable Coriolis influence, resulting in a marked counter-clockwise movement of water in the lower inlet. Similar satellite observations of high latitude circulation should be useful to predict sediment and pollutant trajectories, sites of coastal water fertilization, and potential areas of pelagic fish concentration.

ERTS STUDIES OF ALASKAN COASTAL CIRCULATION

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G.D. Sharma, Institute of Marine Science, University of Alaska

ABSTRACT

Active deglaciation in the mountains of southern Alaska produces large quantities of fine sediment ("glacial flour") which may be used as a tracer to fluvial waters in the coastal zone. Earth Resources Technology Satellite imagery can readily distinguish between turbid, fresh waters and clean marine waters. As well, the scale of ERTS images ($34 \times 10^3 \text{ km}^2/\text{frame}$) provides a unique synoptic view of large scale coastal circulation patterns.

Cook Inlet, one of the largest and most accessible Alaskan estuaries, has been studied in detail using both satellite imagery and conventional oceanographic techniques. In this area, primary fluvial input of turbid waters is in the upper inlet, close to the state's industrial center, Anchorage. It has been demonstrated in Cook Inlet that satellite information effectively delineates domestic and industrial pollutant trajectories, indicates sites of possible hazards to navigation (tidal rips and whirlpools, trash lines containing logs), and may be useful in the prediction of commercial fish migration patterns. Similar information has been obtained for coastal areas too remote or with conditions too severe for conventional operations.

FIFTH BI-MONTHLY PROGRESS REPORT
UNIVERSITY OF ALASKA
ERTS PROJECT 110-8
May 31, 1973

PRINCIPAL INVESTIGATOR: G. D. Sharma and J. J. Burns

TITLE OF INVESTIGATION: Sea Ice and Surface Water Circulation, Alaskan
Continental Shelf

DISCIPLINE: Marine Geology and Ecology

SUMMARY OF SIGNIFICANT RESULTS:

The boundaries of land fast ice, distribution of pack ice and major polynya were studied in the vicinity of Bering Strait. Movement of pack ice during 24 hours was determined by plotting the distinctly identifiable ice floes on ERTS-1 imagery obtained from two consecutive passes.

Considerably large shallow area along the western Seward Peninsula just north of Bering Strait is covered by land fast ice. This ice hinders the movement of ice formed in eastern Chukchi Sea Southward through the Bering Strait. The movement of ice along the Russian coast is relatively faster. Plotting of some of the ice floes indicated movement of ice in excess of 30 km in and south of Bering Strait between 6 and 7 March, 1973. North of Bering Strait the movement of ice approached 18 km. The movement of individual ice floes varied considerably both in southern Chukchi and northern Bering Sea.

The movement of ice observed during March 6 and 7 considerably altered the distribution and extent of polynya. These features when continually plotted should be of considerable aid in navigation of ice breakers. The movement ice will also help delineate the migration and distribution of sea mammals.